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(54) Method and device for the separation of stuff [OR: pulp, stock] mixtures [OR: blends] in the processing and cleaning of printed waste paper

(57) The invention relates to a method for the separation of stuff mixtures in the preparation and purification [OR: cleaning] of printed waste paper, where an already beaten [OR: refined, ground, defibrated] pulp is subjected to at least one flotation step. In accordance with the invention, the flotation occurs in the centrifugal field. Furthermore, the invention relates to a device to perform the aforementioned process.

The following information was taken from documents submitted by the applicant.

<sup>1</sup> Translator's note: The terms in brackets were added by translator they are interchangeable with the preceding term without affecting the integrity of the translation.

## 1 Description

The invention relates to a method to separate stuff mixtures in the preparation and purification of printed waste paper in accordance with the preamble of claim 1, and a device to perform said process.

It has been known since the early Sixties to use flotation as a method to separate stuff mixtures in the preparation and purification of printed waste paper. Flotation in this context refers to a process where a solid matter liquid system to be treated usually comprises several different solid matter components, and where a more or less finely dispersed gas – usually air – flows through said solid matter liquid system. Depending on the different surface-chemical properties of the solid matter components, they will attach more or less selectively to the gas bubbles and are finally transported to the surface of the suspension. The flotation foam forming at said surface is then drawn off. In addition to the surface-chemical properties, the ratio between the gas bubbles and the particles to be floated, as well as the intensity of the turbulence and the structure of the turbulence in the flotation cell, also significantly influence the selectivity of the separation process.

Despite intensive development work, the selectivity of this technique is still not satisfactory. This is shown also in the loss of stuff, which principally cannot be avoided, but the current extent is unsatisfactory. The effectiveness of the Deinking-process cannot be readily qualified. However, the efficiency of the purification, when defined as quantity of the separated printing ink relative to the quantity of the furnished ones, is currently probably in a range of

approximately 60 to 70 per cent. That, however, applies only to the printing inks [OR: paints, dyes, colors] that can be floated relatively easily, i.e., to offset- and high and low pressure inks, but not to water-based flexo-printing inks or for water-based paints in general. In addition, the composition of the paper and especially the surface treatment of the paper also play an important role.

The printing ink particles that are separated from the respective waste paper material suspensions with the help of the flotation process are principally agglomerates of very small primary pigment particles (in the range of a few nanometers) that are more or less hydrophobic, depending on the chemical nature of their bonding agents. Their density is typically in the range of 1, i.e., in the range of the density of the continuous phase (water). The same essentially also applies for dispersed contaminations, which may develop an adhesive potential, but are usually hydrophobic. A spontaneous separation from the continuous phase by sedimentation or (spontaneous) flotation does not occur with either type of particle, primarily because even at significant differences in density, swarm separation speeds are extremely low due to the size spectrum and the conventional density of the material.

The separation [OR: processing, preparation] of the waste paper generally starts with the beating and suspension in so-called pulpers or dissolution drums – currently generally at relatively high material densities (10 to 15 per cent). Usually, all Deinking-chemicals (soaps or fatty acids, caustic soda [OR: soda lye], sodium or potassium water glass, hydrogen peroxide and, if necessary, complexing agent and collecting chemicals) are already added during this

step of the process. If necessary, another beating step follows in a secondary pulper before the rough waste paper contraries are separated in thick-matter purifiers. During the subsequent presorting, smaller impurities are already held back in print sorters with hole- and slit baskets. However, an effective removal of printing ink particles cannot be achieved with this separation process. For this reason, a first flotation step for the removal of printing inks follows in the processing of Deinking-materials. Currently, said flotation step is frequently followed by a dispersing step, where any remaining impurities are comminuted [OR: disintegrated, masticated, crushed]. If there is a high demand for optical quality (degree of whiteness and purity), a second flotation step may follow.

With the known flotation processes, zones are provided within flotation cells, where the air is introduced into the suspension and dispersed. The flotation is then performed in the subsequent less turbulent zones. Finally, zones follow where the formed foam is removed [OR: suctioned off]. The flotation cells constructed in this manner are based exclusively on the use of the surface-chemical properties of the particles, primarily of their hydrophobia, which renders obvious the flotation by means of attachment to gas bubbles. It has been shown by the experiences with, for example, water-based flexo-printing paints and laser-printed waste paper that this strategy is successful only if there is a sufficient level of hydrophobia and the particle sizes are in the ranges that permit the attachment to gas bubbles in the first place (the size spectrum of said gas bubbles in most of the commercially available Deinking-cells is not known and can be influenced only to a limited

extent). With problematic waste papers, the lack of only one of these prerequisites will necessarily lead to unsatisfactory purification results.

The problem to be solved by the present invention is to provide a method, and a device for performing said method, to effectively remove especially printing inks and other impurities from waste paper materials on the basis of the flotation principle.

In accordance with the invention, the problem is solved with a method in accordance with claim 1 and a device for performing the method in accordance with claim 3 and/or claim 5. Thus, the flotation in accordance with the invention is performed in the centrifugal field. Although the flotation with the help of air bubbles will continue to have the dominating effect in the removal of the printing ink and other impurities from the waste paper materials, the speed of separation and especially the selectivity of the separation will be increased and supported by the effect of the centrifugal field. Overall, the flotation cells can also be constructed significantly smaller.

It is especially advantageous if the stuff components of the wastepaper which are largely free of impurities are targeted and separated (positive sorting). In the state of the art, this option of positive sorting had not been taken into consideration. In the known flotation cells, the only attempt was to separate the impurities from the stuff mixture (negative sorting).

A device for the performance of the method in accordance with the invention can have a rotation-symmetrical cell with a tangential intake [OR: inflow, inlet] for the wastepaper. In the area of said intake, gas distribution devices can be arranged over the circumference of

the cell. A rotor to generate the centrifugal field can project into the cell. A foam outlet [OR: discharge, conduit] pipe can project centrally into the cell, and an outlet for the purified material can be joined to the cell.

In accordance with an advantageous embodiment, the rotor can be designed coaxially to the foam outlet pipe and receive said foam outlet pipe in a centric recess. Another device in accordance with the invention can have a rotation-symmetrical cell that has on its one side a coaxial intake pipe for the wastepaper and at the opposing side a coaxial foam outlet pipe. The contents of the cell can be displaced into a rotating movement to generate the centrifugal field, and an air intake and an accepted stock outflow can be provided.

Within the cell, the field of rotation can be generated by a rotor that projects into said cell. Alternately, the centrifugal field can also be generated by the rotation of the cell.

The air intake can be effected through a pipe that runs coaxially to the intake pipe, while the accepted stock outflow can be effected through a pipe that is coaxial to the foam outflow pipe. In that way, the pipe for the air intake and the pipe for the accepted stock outflow can be formed integrally with the cell.

Other details and advantages of the invention are explained in greater detail by means of an embodiment shown in the illustration. Shown are:

Fig.1: A schematic cut representation of a first embodiment of the device in accordance with the invention, and

Fig. 2: a schematic cut representation of a second embodiment of the device in accordance with the invention.

The flotation cell 10 shown in Fig. 1 has a rotation-symmetrical cell 12 that is

essentially comprised of a fixed cylindrical housing. Proceeding from a vertical arrangement of the cell 12 as the one shown in Fig. 1, there is a tangential intake 14 for the so-called gray stock, i.e., the wastepaper that was beaten and mixed with Deinking-chemicals, in the lower part of the cell 12. Also in the lower part of cell 12 is an annular gas distributor 16 with an intake pipe 18 for the gas. An accepted stock outflow pipe 20 is joined at the side of the upper part of cell 12. A foam outflow pipe 22 is inserted coaxially into the rotation-symmetrical cell 12 from above, and said foam outflow pipe enlarges in the shape of a funnel at its free end. A rotor 23 also projects into the cell from above. Said rotor has four rotor blades to mix the contents of cell 12 in a rotation movement. The rotor 24 is arranged coaxially to the foam outflow pipe 22 and receives said foam outflow pipe in a central recess 26, as shown in Fig. 1.

In the device in accordance with Fig. 1, the gray stock enters the cell 12 tangentially and is gassed by the gas distribution devices 16 arranged at the circumference of cell 12. Under the effect of the centrifugal force, the air bubbles 28 are accelerated and guided to the center of the field, whereby their diameter enlarges because of the drop in pressure as a function of the rotational speed. The form created in this way which, depending on the intensity of the turbulence, can also consist of coalescing bubbles with attached impurities, is removed through the foam outflow pipe 22, which dips centrally into the cell 12. In Fig. 1, the floating impurities have the reference symbol 30. The purified stuff 32 collecting in the outer and upper area of the cell 12 is removed by the accepted stock outflow 20. Because of the centrifugal field, a

high separation speed and thus – compared to conventional flotation cells – a clearly reduced size of the cell can be realized with the device in accordance with the invention.

Another structural shape of a device in accordance with the invention is shown in Fig. 2. Parts having the same function are shown here with the same reference symbol as in Fig. 1. In Fig. 2, the cell 12 is constructed of a rotation-symmetrical component that encloses the center of a pipe-shaped component 34. Two truncated cones 36 and/or 38 and the respective pipes 40 and 42 connect to said truncated cones in such a way that a body that is rotation-symmetrical to a symmetry line 44 is achieved. Said cell 12 is formed as a rotating cell. The centrifugal field is generated by the rotation movement of the cell 12. An intake pipe 12 for the gray stock is arranged on one side of cell 12 coaxially to the pipe 42. A foam outflow pipe 22 is arranged coaxially opposite to the pipe 40 of cell 12. The pipe 42 of cell 12, which encloses the intake pipe 14, serves simultaneously as air intake pipe 18. The supplied air is conveyed into the interior of the cell 12 in form of gas bubbles 28 by perforated plates 46 that run parallel to the truncated cone 38.

The pipe 40 of cell 12, which encloses the foam outflow pipe 22, simultaneously serves as accepted stock outflow pipe 20.

In this embodiment, the gray stock is taken into the center of the centrifugal field through the central pipe 14. The centrifugal flow is set up by the cell 12, which can be driven at variable speed. Because of their greater density, the stuff with a greater specific weight is moved toward the outside, i.e., toward the casing of the cell 12, under the field effect of the centrifugal field. The

centrifugal field also performs a positive sorting. Particles with a higher flow resistance as well as particles with a low specific weight remain in the center of the centrifugal field, even if they do not adhere to gas bubbles. Floatable particles adhere to the gas bubbles that flow from the outside toward the inside and are guided into the center of the swirl even if they have a higher specific weight. The accepted stock is removed in the upper area of the cell through the accepted stock outflow pipe 20, while the foam removal is performed through the foam outflow pipe 22, which dips into the center of the swirl.

The device in accordance with the invention can be used to prevent particles that are not very hydrophobic and thus have very poor floating properties, such as flexo-ink particles, from leaving the center of the swirl and reaching the accepted stock, as long as they have a sufficient flow resistance. Because the flow resistance of the components of the suspension is also important, the device in accordance with the invention furthermore effects a fractioning that enables a more selective separation of the gray stock compared to the known flotation processes.

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Patent Claims

1. Method for separating stuff mixtures in the preparation and purification of printed wastepaper, where the beaten and suspended wastepaper, which was mixed with Deinking-chemicals, is subjected to at least one flotation step, characterized in that the flotation is performed in a centrifugal field.
2. Method in accordance with claim 1, characterized in that the fabric stuff components that are largely free of impurities are removed.
3. Device for performing the method in accordance with claim 1 or claim 2, characterized in that a rotation-symmetrical cell has a tangential intake for the wastepaper, that gas distribution devices are arranged in the area of said intake and the circumference of the cell, that a rotor projects into the cell to generate a centrifugal field, that a foam outflow pipe projects centrally into the cell, and that an outflow for the purified accepted stock is joined to the cell.
4. Device in accordance with claim 3, characterized in that the rotor is aligned coaxially to the foam outflow pipe and receives said foam outflow pipe in a centric recess.
5. Device for the performance of the method in accordance with claim 1 or claim 2, characterized in that a rotation-symmetrical cell has on one side a coaxial intake pipe for the wastepaper, and at the opposite side a coaxial foam outflow pipe, that the contents of the cell can be displaced into a rotating movement and that an air intake and an accelerated stock outflow are provided.
6. Device in accordance with claim 5, characterized in that a rotor projects into the cell to generate a rotating movement.

7. Device in accordance with claim 5, characterized in that the cell itself can be displaced into a rotation movement to generate the rotating movement.
8. Device in accordance with one of the claims 5 to 7, characterized in that the air is taken in through a pipe that runs coaxially to the intake pipe.
9. Device in accordance with one of the claims 5 to 8, characterized in that the accelerated stock outflow is performed through a pipe that is coaxial to the foam outflow pipe.
10. Device in accordance with claim 8 or 9, characterized in that the pipe for the air intake and the pipe for the accelerated stock outflow are formed integrally with the cell.

One page of accompanying illustrations.